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## WHERE SHALL WE PLACE THE EMPHASIS?\*

BY W. H. METZLER.

In teaching any subject we must know what it is good for, what powers and abilities it helps to develop. We will then know at what to aim and where to place the emphasis. I am inclined to think that most teachers believe they should teach principles rather than facts, that they should aim at mental power rather than knowledge of details. At the same time many teachers seem to think they are compelled by one circumstance or another to sacrifice their ideals and best judgment. They claim that the material comes to them improperly prepared from below; that much is poor material to start with; that the demands of the colleges are heavy; that examinations covering certain ground await their students at the end of a given time; that their success is measured by the percentage of those students who pass the examinations; that one must teach in the same class, students preparing for college and students preparing for the various walks of life. All these and other causes conspire to lead too many teachers from those high ideals which they know they should and in most cases would like to follow. The justice of these claims has more or less validity under certain circumstances, but in the main I think there is no real good reason why these ideals should be departed from.

This organization should be the leader, for the territory which it covers at least, in emancipating teachers of mathematics from these yokes of bondage which draw them from proper ideals.

If the material is poor or comes to us in any stage poorly prepared we have simply to make the best of it and that is surely not done by aiming at facts but by aiming at principles and methods and to obtain as much mental power as possible.

The demands of the colleges are perhaps in some cases too heavy. Too heavy in that they lay too much stress on the facts or demand too much ground to be covered well in the allotted time. In my judgment a student who has covered two thirds or three fourths of the work well is better prepared than one who has covered the whole ground indifferently or even moder-

\* Read at the annual meeting, Lancaster, Pa.

ately well. If colleges are demanding too much, which I think is not true of most of them, it would be decidedly to their advantage to demand less, and if they do not modify their demands, I think secondary schools would be justified in covering only so much of the ground as can be done well in the time. For myself I would prefer that a student come to college lacking in the quantity rather than in the quality of his mathematics, if there is to be a lack at either point.

Examinations will be ever with us, though it is to be hoped that they will not always continue to be quite so much of a bugbear as now. The bugbear will disappear as soon as students come to their examinations properly prepared. It is perhaps not usual but it is quite possible for students to enjoy examinations and they all will enjoy them when they are so prepared that they feel that they can pass any reasonable examination on the subject. Every healthy person likes once in a while to test their strength, mental as well as physical. Let those students who cannot thus be prepared well in the allotted time take longer for it. Some students have more ability than others and some are slower than others. In view of these facts, it seems strange that so many teachers expect every member of a class to do the same work almost equally well in the same time. We must not try to bring all to the same level of development. There must be development for all and the greater the ability the greater should be the accomplishment demanded, otherwise the parable of the talents has no meaning. Here I would like to put in a little plea for those students of rather exceptional ability. In a class of any size they are apt to get overlooked if indeed they are always recognized. They can without effort do their work as well or better than the rest, so they beat time and do but little. These students, few though they be in number, should have work which would exercise them and put their powers to the test; otherwise they will not develop and will never amount to much with all their ability. Does not the lower third too often set the pace for the whole class? This lower third of the class needs attention and a good deal of it, but they and the middle third should not receive it all.

If students were not allowed to come up for examination until they are prepared, then the percentage of those who pass would be high in all cases. This surely can be done if all will work for it.

Now the teaching of students preparing for all kinds of work in one class has, I think, no disadvantages connected with it. I would like to lay down the thesis that, for the most part, the best preparation for college is the best preparation for life and the best preparation for life is the best preparation for college. In making this statement I have in mind that in connection with most subjects it is the character of the work in rather than the contained facts which are of most importance. Facts have a large value, but it is training that counts for most. A few years ago it used to be said that a college education spoiled a man for business. This came from the man of business and was probably due to the fact that the college education did not equip him with the technique of that particular business. Given a chance, however, the properly trained college man soon showed that he could rapidly master the technique and that he possessed an ability and power which enabled him to forge ahead of his non-college-trained competitor, and today the man with college training is in demand for all phases of business life. This fact alone should be sufficient to prove my thesis. If we look into the case carefully we will find that that which enables the college man to succeed is not the possession of a large body of facts, but rather that ability and willingness to take any body of facts, sift them, taking those which are essential, and after careful and critical consideration produce a solution of the problem connected with them.

Among the most important things a student can get out of a course is to learn the tools to be used and the methods and principles of using those tools to solve its problems. These, together with a well-developed will to make them work and a strong character to give their work expression, are large assets in the equipment of an individual in any walk of life. All training should have for its end a broader and a larger life.

Having considered these causes one by one I trust I have shown that there exists no good reason for which teachers should forsake that which they know to be best in object and aim. To carry out our convictions in spite of difficulties we need courage and to give encouragement. The student needs much of the latter. Criticism and commendation both cultivate, the one cultivates the bad and the other the good. We should encourage by commending the good in a pupil and

thereby give them courage to do what they might otherwise be unable to do.

I should like in the time remaining to illustrate briefly from the subject of geometry something of what I mean by teaching principles. In the first place I may say that to study geometry for the mere body of facts it contains is a waste of time for most students, and I wish to add that if facts alone are aimed at little else will be acquired. I suspect that most students of geometry in the secondary schools, even if they know how to prove most of the propositions, have little real knowledge of geometrical principles and methods.

I would begin by laying down just what was necessary for a foundation and then with these tools teach the student at every point to see—(1) what tools he has, (2) which of these tools are applicable to the case in hand, (3) how to use them for its solution. Early in the course I would bring out the fact of pure logic, that to every proposition there corresponds three and but three others; its converse, its obverse and its contrapositive or, to use terms that would perhaps be better for students in geometry, its converse, its negative and its negative converse. We have thus the four propositions:

- (1) If  $A$  is true then  $B$  is true,
- (2) If  $B$  is true then  $A$  is true,
- (3) If  $A$  is not true then  $B$  is not true,
- (4) If  $B$  is not true then  $A$  is not true.

From these it may readily be seen that they go in pairs. Nos. (3) and (4) bear the same relation to each other as (1) and (2); (1) and (3) the same relation as (2) and (4); (1) and (4) the same relation as (2) and (3). It is also readily seen that the contrapositive of a proposition readily follows as a necessary consequence of the proposition. That is, it follows from pure reasoning without the use of any other propositions. Thus (4) follows from (1) and (3) follows from (2) and vice versa. It follows from this that if two, viz., the proposition and its converse, are true, then all four are true. This alone will go a long way to give system, method and direction to the work of the student. He must know just what synthesis consists of, what analysis means and how it can be used, as well as the indirect method of proof. Knowing these, he will have clear and practically complete guiding principles in the solution

of geometrical problems and not do as many students do, finish elementary geometry with the idea that it is a set of puzzles which are to be tried as a puzzle with little if any method.

These are briefly some indications of what I mean by principles and methods. A student thus equipped will have a set of tools and a knowledge of their use, so that he can carve out the solution of most any geometrical problem, whether old or new. Some of you have in your teaching been paying attention to these things and will agree with me that geometry thus studied and taught has not only great interest, but a value almost immeasurable.

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### ELEMENTARY LOGIC AS A BASIS FOR PLANE GEOMETRY.\*

BY EUGENE R. SMITH.

This paper is the report of an experiment which I have been trying in my classes, and it will on that account necessitate a frequent use of the personal pronoun.

Some nine years ago, my attention was attracted by the numerous mistakes in elementary logic which my pupils made. I began to wonder whether logic was a natural or an acquired habit, and to be on the lookout for errors of the same kind outside my classes.

I soon found that many men in everyday life were prone to use the converse or the obverse of a known statement, if it happened to suit their purposes, without the slightest qualm. Within a short period of time I heard two striking illustrations of this. In the first place a well-known speaker demonstrated that certain conditions were always followed by certain consequences, and ended up in a burst of eloquence with the statement that since those consequences were now present in our country, the conditions must be abroad in the land.

In the second case, the debating team of one of our large high schools attempted to win a debate by the very same kind of reasoning. As one of the judges I had to disallow the entire

\* Read at the annual meeting, Lancaster, Pa.